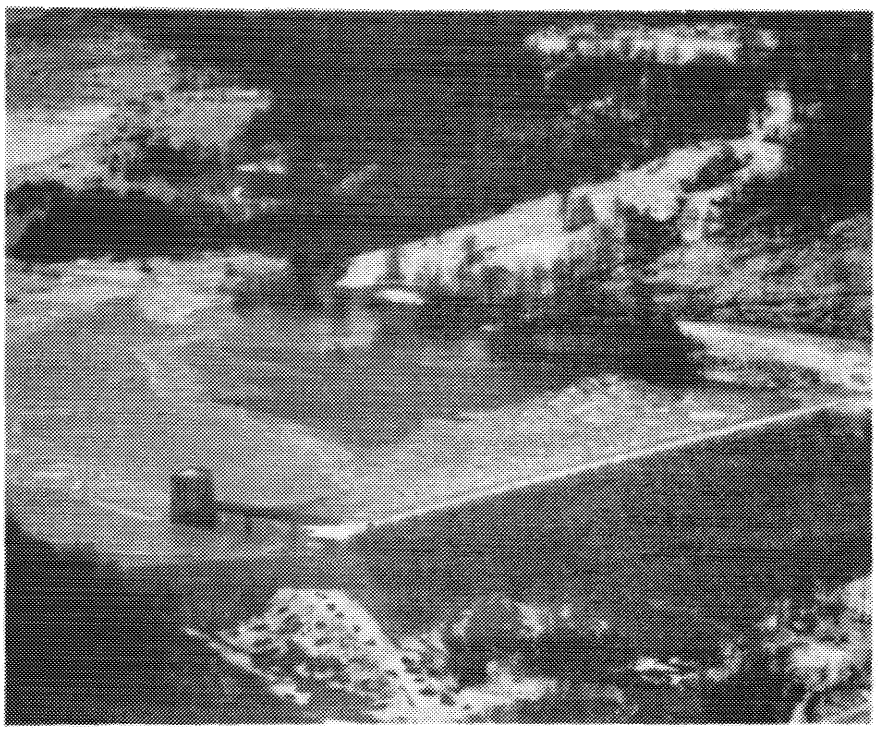
NEW ENGLAND FLOODS OF 1955



PART 5

EFFECT OF FLOOD CONTROL PROJECTS

Corps of Engineers, U.S. Army - Office of the Division Engineer
New England Division - Boston, Mass.

NEW ENGLAND FLOODS OF 1955

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APRIL 1956

ARMY-NED-BOSTON

NEW ENGLAND FLOODS OF 1955

PART V - EFFECT OF FLOOD CONTROL PROJECTS

FOREWARD

This is Part V of a report in five parts on New England Floods of 1955.

The complete report presents the results of preliminary studies and investigations of the floods which occurred in New England as a result of the tropical storms of August and October 1955. The scope of data included in this report is limited to the material useful to the Corps of Engineers in studies pertaining to flood control investigations.

The complete report comprises five parts:

Part I - Storm Data.

Part II - Flood Discharges.

Part III - Flood Profiles.

Part IV - Flood Damages.

Part V - Effect of Flood Control Projects.

NEW ENGLAND FLOODS OF 1955

PART V - EFFECT OF FLOOD CONTROL PROJECTS

CONTENTS

NEW ENGLAND FLOODS OF 1955

PART V - EFFECT OF FLOOD CONTROL PROJECTS

CONTENTS (Cont'd)

NEW ENGLAND FLOODS OF 1955

PART V - EFFECT OF FLOOD CONTROL PROJECTS

CONTENTS (Cont'd)

NEW ENGLAND FLOODS OF 1955

PART V - EFFECT OF FLOOD CONTROL PROJECTS

LIST OF TABLES

NEW ENGLAND FLOODS OF 1955

PART V - EFFECT OF FLOOD CONTROL PROJECTS

LIST OF PLATES

PART V - EFFECT OF FLOOD CONTROL PROJECTS

GENERAL INTRODUCTION

1. Scope and Purpose. - Part V describes the operation of existing flood control projects during the floods caused by "Hurricane Connie," "Hurricane Diane," and the storm of October 14-17, and analyzes the effe tiveness of the operation of the reservoirs in reducing downstream flood flows and flood losses.

2. General. - There are nine completed flood control reservoirs in New England which are under the jurisdiction of the New England Division. Five are located in the Connecticut River Basin, three in the Merrimack River Basin, and one in the Thames River Basin. Pertinent data relative to the location, drainage area and storage capacity of each reservoir are tabulated in Table 1. Although all nine reservoirs were regulated during the floods of August and October 1955, only two reservoirs were located in the storm area and produced significant benefits. A summary of the regulation at each reservoir for the three flood periods, including data on rainfall, records of maximum pool stages, computed peak inflows, regula outflows and amounts of storage utilized, is shown in Table 2.

3. Local protection projects located along the Connecticut River were very effective in preventing flood damages. High river stages were kept out of the diked areas, and pumping stations, many of which operated at maximum capacity, adequately provided for the interior drainage.

"HURRICANE CONNIE"

4. General. - Dry antecedent conditions preceded "Hurricane Connie" and the initial precipitation produced very little runoff. However, because of the intensity of the rain, the gates at all reservoirs in the Connecticut and Thames River Basins were closed during the evening of 13 August in accordance with emergency procedure during hurricanes. Only minor rises were experienced in the Connecticut and Thames River Basins and releases from the reservoirs in those Basins were initiated on 14 August. Storage utilized during this regulation was generally insignificant with a maximum of eleven percent being used at Knightville Reservoir in the Connecticut River Basin. The regulation of the reservoirs in the Connecticut River Basin and in the Thames River Basin during "Hurricane Connie" are shown on Plates 1 through 6. Operators of the flood control reservoirs in the Merrimack River Basin were alerted for possible emergency operation, but heavy rainfall did not occur in New Hampshire.

5. No analysis was made to determine the effectiveness of existing flood control projects during "Hurricane Connie" because only minor flooding occurred and only small amounts of water were stored in the reservoirs.

"HURRICANE DIANE"

6. General. - When heavy rainfall amounts were reported in southern New England on 18 August, all nine reservoirs were placed on emergency regulation in anticipation of possible communication failures. However, appreciable rainfall was experienced only over two watersheds controlled

by flood control reservoirs, namely, Knightville Reservoir in the Connecticut River Basin and Mansfield Hollow Reservoir in the Thames River Basin. (See Plate No. 3 in Part I.) Regulation of these reservoirs was effective in reducing flood stages in each basin. Since the heavy rainfall did not extend beyond northern Massachusetts, the regulation of reservoirs located in northern Massachusetts, New Hampshire and Vermont was of minor significance. The gates at all reservoirs were gradually opened when the flood waters receded below flood stage at the damage centers. Plates 1 through 6 illustrate the regulation of the reservoirs in the Connecticut River Basin and Thames River Basin.

Connecticut River Basin

7. Regulation of Knightville Reservoir. - Of the five existing flood control reservoirs in the Connecticut River Basin, only Knightville Reservoir, located on the Westfield River, was effective in reducing flood flows during "Hurricane Diane." The gates at Knightville were closed on Thursday, 18 August at 11:00 a.m. (E.D.S.T.) when a total of two inches of rain was recorded at the dam and the flow at Huntington, located below the junction of the Middle and West Branches of the Westfield River, was 1500 c.f.s. and increasing rapidly. By 4:00 p.m., the total flow at Huntington exceeded 9,000 c.f.s. The first flood peak crested at Westfield, Massachusetts at 9:00 p.m. with a peak discharge of 19,600 c.f.s. Precipitation, which had practically stopped during Thursday afternoon, became heavy again during the night and by 4:00 a.m. on Friday, 19 August a total of 7.25 inches had been recorded at the dam. Four inches of this total were recorded in the preceding seven hours. Severe flooding followed the

intense rainfall and the second flood peak crested at Westfield at 8:00 a.m. with a discharge of 70,300 c.f.s. The gates at Knightville Reservoir remained closed until the morning of 22 August when the flood waters on the Westfield River and the lower Connecticut River receded below flood stage. The regulated outflow was retarded from 24 August to 28 August to maintain a high pool stage for gate testing by the Waterways Experiment Station. The reservoir was back to normal operation on 30 August.

8. Effectiveness of Regulation. - The storm during "Hurricane Diane" centered over the lower Westfield River Basin with total rainfall amounting to nearly 20 inches, and despite the regulation of Knightville Reservoir, the runoff from this severe storm caused the greatest flood of record in the lower Westfield River. The maximum flow at Westfield was 70,300 c.f.s. with a corresponding stage of 34.2 feet. Although the area controlled by Knightville Reservoir was on the fringe of the center of heavy rainfall, the peak discharge reduction provided by the operation of Knightville Reservoir at Westfield, Massachusetts was 10,700 c.f.s., equivalent to a stage reduction of four feet. Without Knightville Reservoir, the natural peak flow on the Westfield River at Westfield would have been 81,000 c.f.s., or 1.5 times the previous flood of record (55,500 c.f.s.). Stage reductions at damage centers on the Connecticut River, attributable to the regulation of Knightville Reservoir, amounted to 0.6 feet. Table 3 summarizes the stage and discharge reductions afforded by Knightville Reservoir at principal damage centers.

9. Analysis of the flood development on the Connecticut River, as described in Part II, indicates that the flood flows at Thompsonville and Hartford, Connecticut were generated by the runoff from the area below

Montague City, Massachusetts, and that the peak flow at Thompsonville occurred only 24 hours after the start of the heavy rainfall. Because of this rapid concentration of runoff in the lower part of the Connecticut River Basin, and the relatively light rainfall over the areas controlled by Union Village, Surry Mountain, Birch Hill and Tully Reservoirs, the effectiveness of these reservoirs was negligible.

10. Local Protection Projects. - There are ten local protection projects in the Connecticut River Basin; nine on the main Connecticut River and one at Winsted, Connecticut, on Mad River, a tributary of the Farmington River. All projects on the Connecticut River consist of dikes, walls - or a combination of both - stop-log structures and pumping stations. With the exception of Winsted, the local protective measures prevented any damage from river flooding in each of their respective communities. A comparison of the water surface elevations of the floods of record and the standard project flood with the design elevation of local protection projects at selected locations is shown on Plate 7. The projects and their operations during "Hurricane Diane" are described in the following paragraphs.

11. Northampton, Massachusetts. - This project consists of earth dikes, a concrete flood wall on the right bank of the Connecticut River, a canal to divert Mill River, a pumping station and appurtenant stop-log and drainage structures. During "Hurricane Diane" the dikes protected the city of Northampton from all river flooding and the pumping station operated at maximum capacity from 8:30 a.m. to 1:00 p.m. on 19 August. Local runoff caused damage within the protected area and access ramps

at several locations on the dike were eroded. The maximum high water elevation at Calvin Coolidge Bridge in Northampton was approximately 114.0 feet, m.s.l., 18.0 feet below the top of the dike.

12. Holyoke, Massachusetts. - This project consists of earth dikes, concrete flood walls along the right bank of the Connecticut River, six pumping stations for the disposal of interior drainage and numerous stop-log and gate structures. During "Hurricane Diane" the Holyoke local protection measures protected the city from all river flood flows. Three of the six pumping stations were operated from noon on 19 August to 7:00 a.m. on 20 August. Since the Connecticut River was at low stage when the heaviest rainfall occurred in Holyoke, a large amount of the local runoff was discharged by gravity. Interior damages were due to local rainfall and runoff which could not be handled by the sewerage systems.

13. Springdale, Massachusetts. - This project, consisting of a dike, concrete flood wall and pumping station on the right bank of the Connecticut River in the Springdale section of Holyoke, forms an integral part of the local protection for Holyoke, The Springdale area was completely protected from river flooding. The pumping station operated continuously from 7:30 a.m., 18 August to 2:30 p.m., 19 August. The local runoff which could not be handled by the drainage systems caused the damage which occurred within the protected area.

14. Chicopee, Massachusetts. - This project consists of an earth dike, a concrete flood wall along the left bank of the Connecticut River, six pumping stations and stop-logs and appurtenant drainage structures. The dikes and walls completely protected the city from river flooding.

All six pumping stations operated intermittently from 18 August to 24 August. Flooding which occurred within the city was caused by the insufficient capacity of the drainage system. On 19 August the water surface elevation rose to 61.4 feet, m.s.l. at the Chicopee-West Springfield Bridge, 11.6 feet below the top of the dike. This is the highest elevation recorded since the completion of the local protection works in 1941.

15. Riverdale, Massachusetts. - The Riverdale section of West Springfield, Massachusetts, located on the right bank of the Connecticut River, is protected by an earth dike and two pumping stations. The operation of the two pumping stations throughout the 19 August was adequate for the interior drainage. Flood damage which occurred within the protected area resulted from local runoff which the drainage system could not handle. The dike completely protected the area from the flood flows of the Connecticut River. A section of the Riverdale Road on Route 5, about 100 feet north of the Riverdale Dike Stop-Log Structure No. 1, was washed out as a result of an inadequate highway culvert. The dike and the stop-log structure were threatened by the washout, but no material damage developed.

16. West Springfield, Massachusetts. - The town of West Springfield, located at the confluence of the Connecticut and Westfield Rivers, is protected by a system of dikes and flood walls extending along the right bank of the Connecticut River and the left bank of the Westfield River. Three federally constructed pumping stations are included in this project. During "Hurricane Diane" the local protection works saved the city of West Springfield from the flood flows of the Connecticut and Westfield Rivers. All three pumping stations were operated during the flood, the Bridge Street Pumping

Station being operated at maximum capacity from 8:00 p.m. 18 August until 8:00 a.m. 19 August. The pond at Circuit Avenue was not pumped until 20 August when it reached elevation 48.6 feet, m.s.l. A reconnaissance of the project during the flood revealed two damaged areas on the river side of the dike; one section, approximately 15 feet square and up to six feet deep at the toe of the dike, was washed out; at another section on River Road, near a 12-inch storm drain outlet, riprap and bedding were washed away. Damage from local run-off which occurred within the city was caused by inadequate drainage.

17. Springfield, Massachusetts. - Springfield is protected by dikes, flood walls, five pumping stations and appurtenant drainage features. The local protection projects completely protected the city from river flooding. Although the occurrence of the local run-off did not coincide with the flood stages on the Connecticut River, it was necessary for two of the five pumping stations to be operated at maximum capacity in the early morning hours of 19 August. Flooding within the city was due to intense run-off which the drainage system was unable to handle. The maximum stage of the Connecticut River recorded at the Memorial Bridge in Springfield was 58.4 feet, m.s.l. on 19 August, eight feet below the top of the flood wall.

18. Hartford, Connecticut. - Flood control measures at Hartford consist of concrete flood walls, earth dikes, pumping stations, stop-log structures, appurtenant drainage facilities, and a pressure conduit. Although it developed entirely south of Vermont and New Hampshire the concentrated run-off resulting from Hurricane "Diane" created the third highest flood elevation of record at Hartford. On 20 August, the river crested at elevation 30.1 feet, m.s.l. at the Hartford Memorial Bridge, 13.8 feet below the top of the flood wall. The pressure conduit in the Park River, which has a design capacity

of 18,000 c.f.s., safely discharged the observed flow of 16,000 c.f.s. All stop-log structures in Hartford were closed in accordance with prescribed procedures. Although stop-log No. 1 leaked at the sill because of improper sandbagging, no trouble was encountered with the water levels which were experienced. Minor flooding occurred in the vicinity of the North Meadows Pumping Station when operation of the pumps was delayed and then were run at only 66 per cent of their normal speed. At the Keeney Lane Pumping Station the operator encountered many difficulties in starting the pumps and, because of his unfamiliarity with the project, did not operate the pumps according to schedule or at capacity. The city officials are aware that valuable time was lost because they were neither properly prepared nor orgainzed to put the flood control projects into immediate operation. This was the first test of the project since its completion in 1944.

19. East Hartford, Connecticut. - The project at East Hartford consists of an earth dike and a concrete wall along the Connecticut and Hockanum Rivers, three pumping stations, stop-log structures and appurtenant drainage facilities. The maximum water surface elevation of the Connecticut River was 7.8 feet below the top of the flood wall. The dikes functioned satisfactorily, and stop-logs, which were installed at Main Street, withheld a depth of about two feet of water. The operation of the Meadow Hill Pumping Station kept the water in the storage pond at a satisfactory level. The dikes were well patrolled and no damages occurred.

20. Winsted, Connecticut. - The channel of the Mad River through Winsted, Connecticut was improved in 1951. Physical properties overhanging and adjacent to the river limited the improvement to a design discharge of 5,000 c.f.s.. During "Hurricane Diane" this channel was not adequate to contain the tremendous

flood flows, estimated to be 16,000 c.f.s., and flood waters surged through the center of Winsted producing catastrophic damage, as further described in Part IV.

Thames River Basin

21. Regulation of Mansfield Hollow Reservoir. - Mansfield Hollow Reservoir, the only existing flood control reservoir in the Thames River Basin, is operated to protect communities along the Natchaug, Shetucket and Thames Rivers. The gates at Mansfield Hollow were closed from 13 August through 22 August except for small regulated outflows to satisfy the water requirements of downstream users. During "Hurricane Connie" regulation at Mansfield Hollow Reservoir was initiated to reduce flow on the Shetucket River in order to protect a dam which was under construction at Baltic Mills. During "Hurricane Diane" the average rainfall over the Mansfield Hollow watershed totalled eight inches. The elevation of the reservoir pool during this period increased from 17.8 feet to a maximun of 51.8 feet, equivalent to 35,000 acre feet of storage, or 67 per cent of the storage capacity of the reservoir. This is the highest pool stage since the completion of the reservoir in March 1952. When the flood waters at the damage centers receded below flood stage, the gates at Mansfield Hollow were gradually opened and a regulated discharge was maintained at 3,000 c.f.s. until 1 September when the reservoir was back to normal operation.

22. Effectiveness of Regulation of Mansfield Hollow Reservoir. - The regulation of Mansfield Hollow Reservoir during "Hurricane Diane" was effective in reducing flood flows at the downstream damage centers along the Natchaug, and Shetucket Rivers. Backwater from the Shetucket River produced flood stages in the Natchaug River in the vicinity of the "Brick Top" section of

Willimantic. Without regulation the natural stage would have been six feet higher, and would have resulted in serious damage to the residential section of Willimantic. A summary of the stage and discharge reductions afforded by Mansfield Hollow Reservoir at the principal damage centers is shown on Table 4.

23. Channel Improvement Project at Norwich, Connecticut. - This improvement, which is 70 per cent completed, consists of widening and deepening the Shetucket River in the vicinity of Norwich. During "Hurricane Diane" the partially completed improvements reduced the peak flood stage at Norwich by three feet.

STORM OF OCTOBER 1955

24. General. - Heavy rainfall amounts in southern New England on 15 October, required the closure of gates at five of the nine existing flood control reservoirs and the alerting of the remaining four for emergency operation. The flooding which resulted from the heavy rainfall was confined principally to tributaries in southwestern Massachusetts and western Connecticut. Knightville Reservoir in the Connecticut River Basin and Mansfield Hollow in the Thames River Basin again were effective in reducing flood stages in their respective basins. Regulated releases at the reservoirs were initiated when the flood flows had receded at the damage centers.

Connecticut River Basin

25. Regulation of Reservoirs. - All reservoirs in the Connecticut River Basin, with the exception of Union Village Reservoir, were regulated during the storm of October 14-17. The gates at Knightville Reservoir were closed on 14 October at 11:00 p.m. when stages on the Westfield River started to rise, and remained closed until the morning of 17 October when the impounded runoff was gradually released. The reservoir was back to normal operation on

30 October. The runoff stored by Knightville Reservoir during the storm created a maximum pool stage of 127.8 feet on 18 October, which is only 2.2 feet below spillway crest. It was the second highest pool stage recorded since the reservoir was completed in 1941. Pertinent data relative to the regulation of Knightville Reservoir is tabulated in Table 2 and shown graphically on Plate 12.

26. The gates at Surry Mountain, Birch Hill, and Tully Reservoirs were closed on the morning of 15 October to reduce possible flooding on their respective tributaries and to desynchronize their flows from the flood crest on the Connecticut River. On the morning of 18 October when it was evident that no flooding was occurring on the tributaries downstream of the reservoirs, and that flood flows on the Connecticut River were below flood stage, releases from the reservoirs were initiated. The reservoirs were back to normal operation on 31 October. Table 2 summarizes the regulation at Surry Mountain, Birch Hill, and Tully Reservoirs during the October flood, and Plates 9, 10, and 11 graphically illustrate the regulation.

27. Effectiveness of Regulation of Knightville Reservoir. - The runoff retained by Knightville Reservoir during the October 1955 flood effectively reduced the peak discharge at Westfield, Massachusetts by 13,500 c.f.s., equivalent to a stage reduction of 4.5 feet. On the lower Connecticut River, the operation of Knightville Reservoir reduced the stage at Springfield, Massachusetts and Hartford, Connecticut by 0.8 feet and 1.0 feet respectively. The stage and discharge reductions afforded by Knightville Reservoir at the principal damage centers are summarized in Table 3.

28. The storm of October 1955 caused high flows on the Connecticut River during two separate periods. The first peak, the higher of the two, occurred between the 15th and 16th, while the second peak occurred on the 18th. The first peak was caused by run-off from the western portion of the lower Connecticut River Basin, while the second peak was caused by run-off from the eastern portion of the Connecticut River Basin. Since there was very little flow contribution from the eastern portion of the Connecticut River Basin to the first peak, the effectiveness of Birch Hill, Tully and Surry Mountain Reservoirs was not significant.

29. Local Protection Projects. - The communities in the Connecticut River Basin which are located in the vicinity of the ten local protection projects were completely protected from river flooding resulting from the October 1955 storm. The peak elevations on the Main Connecticut River were well below the design elevation of the dikes and walls. Pumping stations and appurtenant drainage structures adequately drained local run-off which was much less intense than that experienced during Hurricane "Diane".

30. Winsted, Connecticut. - After Hurricane "Diane", the Winsted Channel Improvement Project was repaired in time to protect the city of Winsted from moderate flood flows of the Mad River. During the October flood, the estimated maximum discharge of 5,000 c.f.s., equivalent to the design discharge for the project, was effectively confined within the banks of Mad River.

Thames River Basin

31. Regulation of Mansfield Hollow Reservoir. - Mansfield Hollow Reservoir was regulated during the October flood to protect downstream communities from serious flooding. The gates at the dam were partially closed at 11:00 p.m. on 14 October and completely closed at 3:00 a.m. on 15 October. The gates remained closed until the flood flows at the downstream damage centers had

receded below flood stage. On the morning of 17 October regulated discharge was started and continued until 24 October when the reservoir returned to normal operation.

32. Effectiveness of Regulation of Mansfield Hollow Reservoir. - The stage reduction afforded by the operation of Mansfield Hollow Reservoir during the October flood at Willimantic, Connecticut amounted to 2.5 feet. On the Shetucket River at Greenville Dam in Norwich the stage reduction attributable to the operation of the reservoir was one foot.

33. Channel Improvement Project at Norwich, Connecticut. - The partially completed Norwich Channel Improvement reduced the flood stage at Norwich by approximately one foot.

Norwalk River Basin.

34. Local Protection Project at Norwalk, Connecticut. - The Norwalk project consisted of widening and deepening of the channel of the Norwalk River, a spoil dike on the right bank of the river and an hydraulic control downstream from Perry Avenue Bridge to prevent scour from undermining the bridge footings. Because of physical and economic considerations, the project was designed for a flow of 4,000 c.f.s. which was estimated to be about twice the maximum flood of record. The flood of October 1955, which was approximately five times greater than the previous flood of record, caused considerable damage. A section of the dike was breached by the high stages but has subsequently been repaired at a cost of $15,000. The hydraulic control structure was destroyed as the flood waters swept around both sides of the control, eroding away the natural river banks. The estimated cost of replacing the hydraulic control and restoring the river bank is $25,000.

BENEFITS - "HURRICANE DIANE" AND STORM OF OCTOBER 1955

Connecticut River Basin

35. Reservoirs and Local Protection Projects. - In the Connecticut River Basin operation of Knightville Reservoir, supplemented by local protection works, prevented damages amounting to $28,198,000 during "Hurricane Diane" and $5,040,000 during the Storm of October 1955. The benefits are allocated to projects as follows:

Flood Control Projects	Benefits "Hurricane Diane"	Benefits Storm of October 1955
Knightville Reservoir		
Westfield River	$ 640,000	$ 860,000
Connecticut River	5,840,000	2,560,000
Total Reservoirs	$ 6,480,000	$3,420,000
Local Protection		
Northampton, Massachusetts	$ 5,000	$ --
Holyoke, Massachusetts	65,000	--
Springdale, Massachusetts	690,000	33,000
Chicopee, Massachusetts	447,000	6,000
Riverdale, Massachusetts	21,000	--
West Springfield, Massachusetts	3,300,000	139,000
Springfield, Massachusetts	1,680,000	--
Hartford, Connecticut	13,050,000	1,309,000
East Hartford, Connecticut	2,460,000	133,000
Winsted, Connecticut	--	--
Total Local Protection	$21,718,000	$1,620,000
Total Connecticut River Basin	$28,198,000	$5,040,000

Thames River Basin.

36. Mansfield Hollow Reservoir and Norwich Channel Improvement. - The total damages prevented by the operation of Mansfield Hollow Reservoir and the Norwich Channel Improvement project during Hurricane "Diane" were $4,305,000 and during the Storm of October 1955 were $250,000. The benefits are allocated to the two projects as follows:

Project	Hurricane "Diane"	Storm of October 1955
Mansfield Hollow Reservoir	$3,190,000	$170,000
Norwich Channel Improvement	1,115,000	80,000
Total Thames River Basin	$4,305,000	$250,000

TABLE 1

PERTINENT DATA-EXISTING FLOOD CONTROL RESERVOIRS

Reservoir	Watershed	Drainage Area (Sq.mi.)	Area Acres	Capacity Acre Feet	Capacity Inches	Placed in Operation
Connecticut River Basin						
Union Village	Ompompanoosuc	126	720	38,000	5.6	1950
Surry Mountain	Ashuelot	100	970	32,500	6.1	1941
Birch Hill	Millers	175	3,200	49,900	5.3	1941
Tully	Millers (Tully)	50	1,130	22,000	8.3	1949
Knightville	Westfield	162	960	49,000	5.6	1941
Thames River Basin						
Mansfield Hollow	Natchaug	159	1,950	52,000	6.1	1952
Merrimack River Basin						
Franklin Falls	Pemigewasset	1,000	2,800	154,000	2.9	1943
Edward MacDowell	Contoocook (Nubanusit)	44	850	12,800	5.5	1950
Blackwater	Contoocook (Blackwater)	128	3,140	46,000	6.7	1941

SUMMARY OF RESERVOIR REGULATION

FLOODS OF AUGUST AND OCTOBER 1955

Reservoir Date of Flood	Drainage Area Sq. Mi.	Total Precipitation Inches	Maximum Pool Feet	Computed Inflow C.F.S.	Regulated Outflow Minimum C.F.S.	Regulated Outflow Maximum C.F.S.	Storage Used Acre Feet	Storage Used % Total
CONNECTICUT RIVER BASIN								
Union Village Dam	126							
August 11 - 14		6.45	54.6	3,400	0	1,700	2,500	7
August 17 - 18		1.33	32.0	--	0	1,100	Negligible	
October 14 - 17		0.60	Minor regulation					
Surry Mountain Dam	100							
August 11 - 14		4.25	16.6	1,600	0	700	1,800	6
August 18 - 19		1.60	14.0	300	0	700	1,100	3
October 14 - 17		1.68	27.3	1,400	0	900	5,800	18
Birch Hill Dam	175							
August 11 - 14		6.27	4.	800	50	700	Negligible	
August 18 - 19		3.52	13.7	1,400	0	850	5,000	12
October 14 - 17		3.28	19.8	2,600	0	2,000	11,800	24
Tully Dam	50							
August 11 - 14		6.43	10.5	400	0	300	Negligible	
August 18 - 19		3.52	16.9	300	0	300	1,200	8
October 14 - 17		3.33	14.4	400	0	300	1,000	5
Knightville Dam	162							
August 12 - 14		6.12	56.3	4,500	0	2,000	5,500	11
August 18 - 19		9.43	105.0	16,000	0	3,600	28,200	58
October 14 - 17		10.11	127.8	20,000	0	3,600	47,000	96
THAMES RIVER BASIN								
Mansfield Hollow Dam	159							
August 11 - 14		5.52	19.0	1,700	0	400	4,000	8
August 18 - 19		6.5	51.8	16,000	0	3,000	35,000	67
October 14 - 17		5.7	37.3	6,600	0	3,000	17,500	34

Table 2

TABLE 3

CONNECTICUT RIVER BASIN

STAGE AND DISCHARGE REDUCTIONS AFFORDED BY

KNIGHTVILLE RESERVOIR

Location	August 1955 Discharge C.F.S.	August 1955 Stage Ft.	October 1955 Discharge C.F.S.	October 1955 Stage Ft.
Westfield, Massachusetts				
Unmodified (1)	81,000	37.2	44,500	26.2
Observed	70,300	34.2	31,000	21.75
Springfield, Massachusetts (2)				
Unmodified (1)	183,000	59.0	100,500	52.4
Observed	174,000	58.4	92,300	51.6
Hartford, Connecticut (3)				
Unmodified (1)	182,100	30.7	122,000	22.9
Observed	177,000	30.1	114,000	21.9

(1) Discharge and Stage that would have occurred without Knightville Reservoir.

(2) Flow measured at U.S.G.S. Gage at Thompsonville, Connecticut.

(3) Flow measured at U.S.G.S. Gage near Middletown, Connecticut.

TABLE 4

THAMES RIVER BASIN

STAGE AND DISCHARGE REDUCTIONS AFFORDED BY

MANSFIELD HOLLOW RESERVOIR

Location	August 1955		October 1955	
	Discharge C.F.S.	Stage Ft.	Discharge C.F.S.	Stage Ft.
Willimantic, Connecticut				
Unmodified (1)	33,200	153.2	14,400	145.6
Observed	21,300	148.7	9,650	142.8
Taftville, Connecticut				
Unmodified (1)	33,500	45.6	20,000	42.0
Observed	22,000	42.6	16,000	40.8
Norwich, Connecticut				
Unmodified (1)	65,500	17.3	33,000	10.4
Observed	56,000	15.4	29,000	9.5

(1) Discharges and stages that would have occurred without Mansfield Hollow Reservoir

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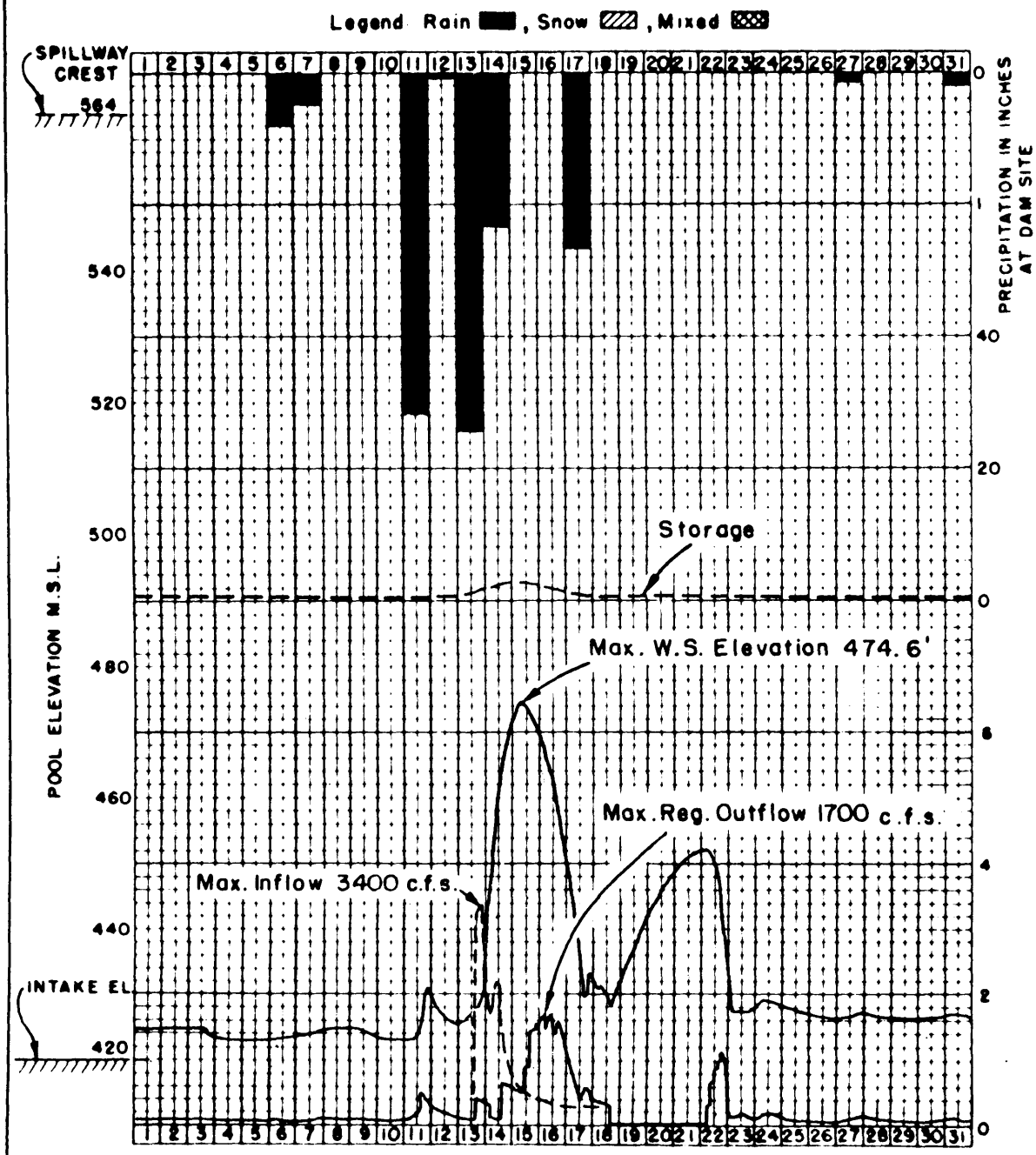


MONTH OF AUG. 1955

	ELEVATION	GROSS STORAGE Ac. Ft.
Conservation Pool	NONE	
Full Pool	564'	30,000

Outlet Capacity at Full Pool 7800 c f s

Invert Elevation at Intake 420 ft m s l

MONTHLY RESERVOIR OPERATION

UNION VILLAGE RESERVOIR

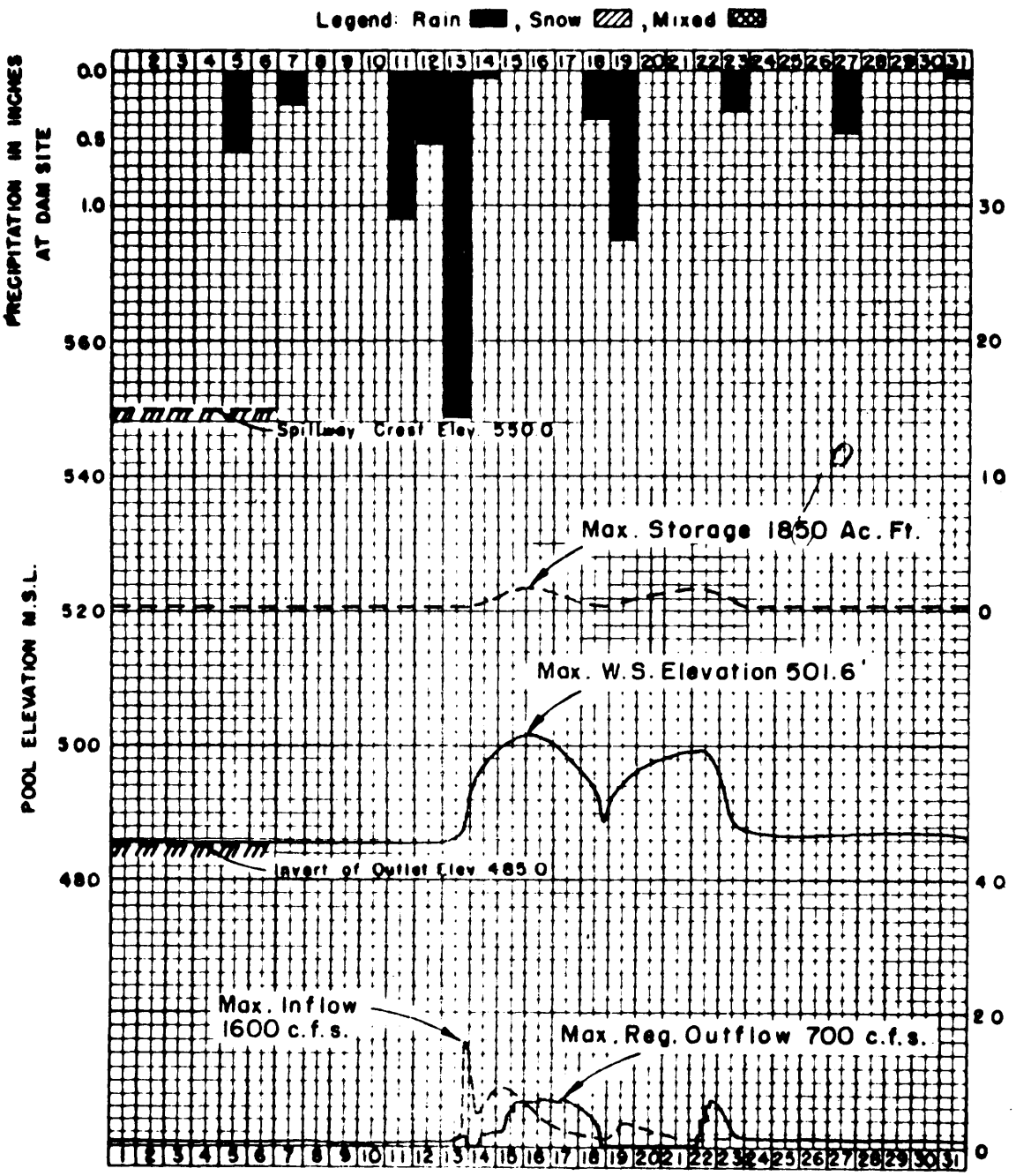
CONNECTICUT RIVER BASIN

D.A. 126 SQ. MILES

NEW ENGLAND DIVISION

BOSTON, MASS

PLATE NO. 1



MONTH OF AUG 19 55

	ELEVATION	GROSS STORAGE Ac. Ft.
Conservation Pool	NONE	
Full Pool	550.0	12[illegible]0

Outlet Capacity at Full Pool 3660 c.f.s

Invert Elevation at Intake 485 ft m.s.l

MONTHLY RESERVOIR OPERATION

SURRY MT RESERVOIR
ASHUELOT RIVER BASIN
D.A. 100 SQ. MILES

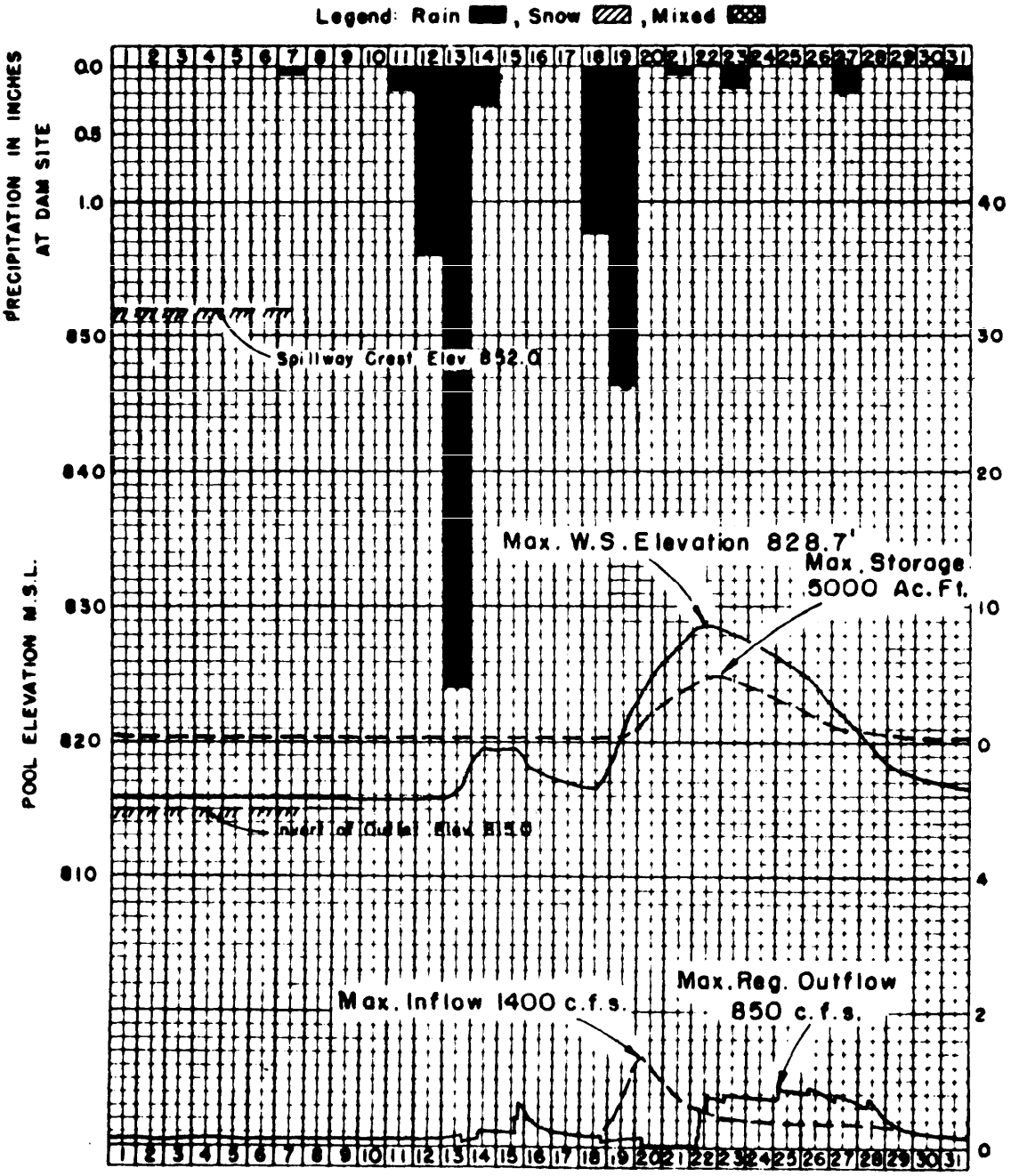
NEW ENGLAND DIVISION
BOSTON, MASS

PLATE NO. 2

U.S. ARMY

CORPS OF ENGINEERS

Control Approval Symbol ENGNV-1



MONTH OF AUG. 1955

	ELEVATION	GROSS STORAGE Ac. Ft.
Conservation Pool	NONE	
Full Pool	852	49,900

Outlet Capacity at Full Pool 10,500 c f s

Invert Elevation at Intake 815 ft m s l

MONTHLY RESERVOIR OPERATION

BIRCH HILL RESERVOIR

MILLERS RIVER BASIN

D A. 175 SQ. MILES

NEW ENGLAND DIVISION

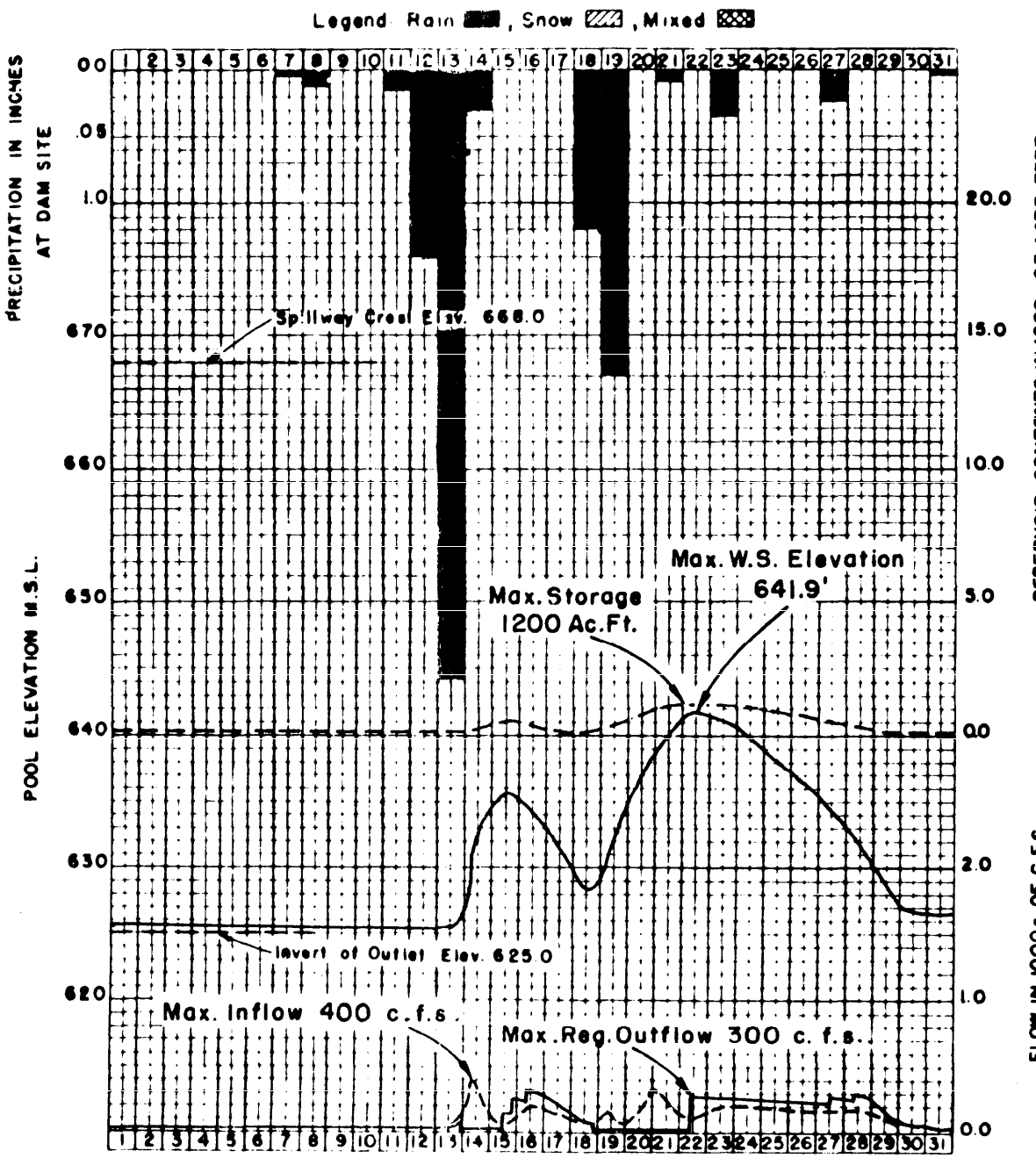
BOSTON, MASS

PLATE NO. 3

U.S. ARMY

CORPS OF ENGINEERS

Control Approval Symbol ENGNV-1



MONTH OF AUG. 1955

	ELEVATION	GROSS STORAGE Ac. Ft.
Conservation Pool	None	
Full Pool	668.0	22,000

Outlet Capacity at Full Pool 1,050 c.f.s.

Invert Elevation at Intake 625.0 ft. m.s.l.

MONTHLY RESERVOIR OPERATION

TULLY RESERVOIR

TULLY RIVER BASIN

D.A. 50 SQ. MILES

NEW ENGLAND DIVISION

BOSTON, MASS.

PLATE NO. 4

AUGUST 1955

RAINFALL IN INCHES

FLOW IN 1000 C.F.S.

ELEVATION IN FEET ABOVE M.S.L.

TOTAL RAINFALL 6.12" AT DAM

TOTAL RAINFALL 9.43" AT DAM
AVERAGE RAINFALL ABOVE DAM APPROX. 6.0"

SPILLWAY CREST

16,000 C.F.S.

MAXIMUM ELEVATION 585.0'
58% OF TOTAL RESERVOIR STORAGE

EL. 536.3'

POOL ELEVATION

7,500 C.F.S.

COMPUTED RESERVOIR INFLOW

OUTLET INVERT

4,500 C.F.S.

COMPUTED RESERVOIR INFLOW

REGULATED OUTFLOW

REGULATED OUTFLOW

REGULATED OUTFLOW

CONNECTICUT RIVER FLOOD CONTROL

REGULATION AT
KNIGHTVILLE RESERVOIR
WESTFIELD RIVER, MASS.
FLOOD OF AUGUST, 1955

NEW ENGLAND DIVISION — BOSTON, MASS.

AUGUST 1955

PLATE NO. 5

AUGUST 1955

TOTAL RAINFALL 5.52" AT DAM

TOTAL RAINFALL 6.50" AT DAM

AVERAGE RAINFALL ABOVE DAM APPROX. 8.5"

16,000 C.F.S.

SPILLWAY CREST

MAXIMUM ELEVATION 246.8'
67% OF TOTAL RESERVOIR STORAGE

COMPUTED RESERVOIR INFLOW

EL. 214.0'

POOL ELEVATION

THAMES RIVER FLOOD CONTROL
REGULATION AT
MANSFIELD HOLLOW RESERVOIR
NATCHAUG RIVER CONNECTICUT
FLOOD OF AUGUST 1955
NEW ENGLAND DIVISION – BOSTON, MASS.

OUTLET INVERT

REGULATED OUTFLOW

1,700 C.F.S.

COMPUTED RESERVOIR INFLOW

REG. OUTFLOW

REGULATED OUTFLOW

RAINFALL - INCHES

FLOW IN THOUSAND C.F.S.

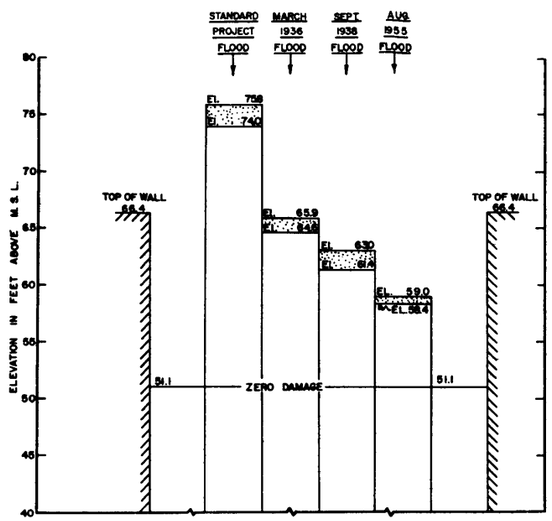
ELEVATION IN FEET ABOVE M.S.L.

AUGUST 1955

PLATE NO. 6

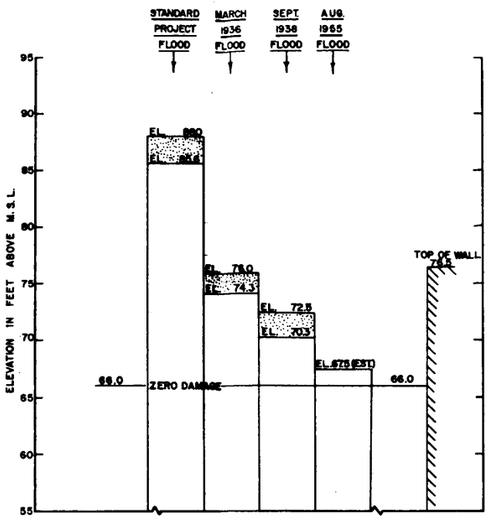
CORPS OF ENGINEERS

U.S. ARMY



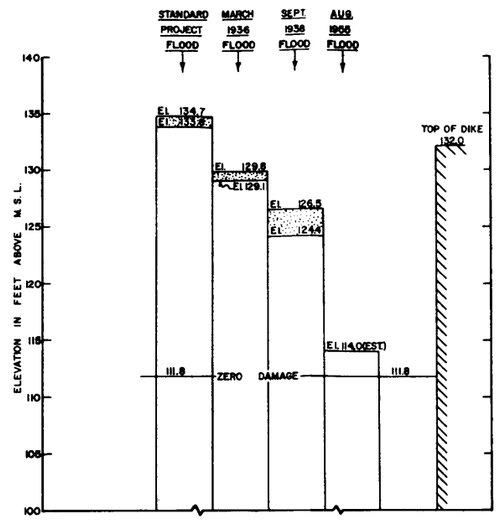
SPRINGFIELD-WEST SPRINGFIELD

(SPRINGFIELD MEMORIAL BRIDGE)



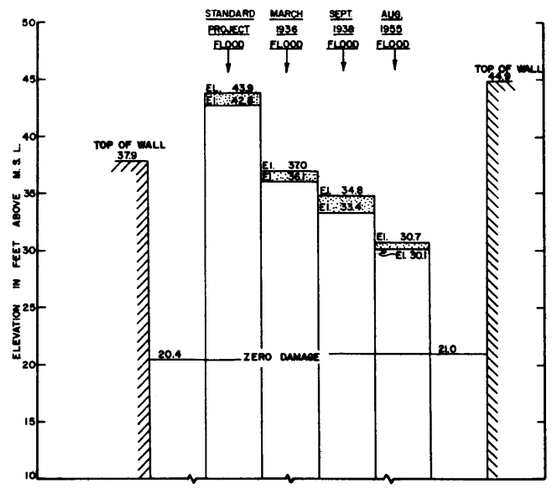
HOLYOKE

(GILL GAGE)



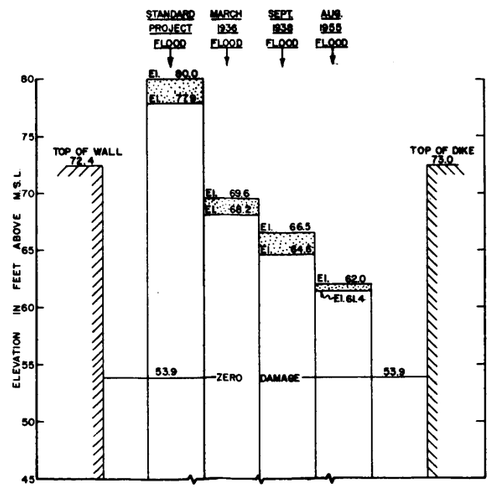
NORTHAMPTON

(CALVIN COOLIDGE BRIDGE)



EAST HARTFORD - HARTFORD

(HARTFORD MEMORIAL BRIDGE)



CHICOPEE - RIVERDALE

(CHICOPEE-WEST SPRINGFIELD BRIDGE)

LEGEND

NATURAL

MODIFIED BY FIVE EXISTING RESERVOIRS

NOTE

All sections taken looking downstream.

COMPARISON OF FLOOD ELEVATIONS AT LOCAL PROTECTION AREAS

NEW ENGLAND DIVISION BOSTON, MASS.

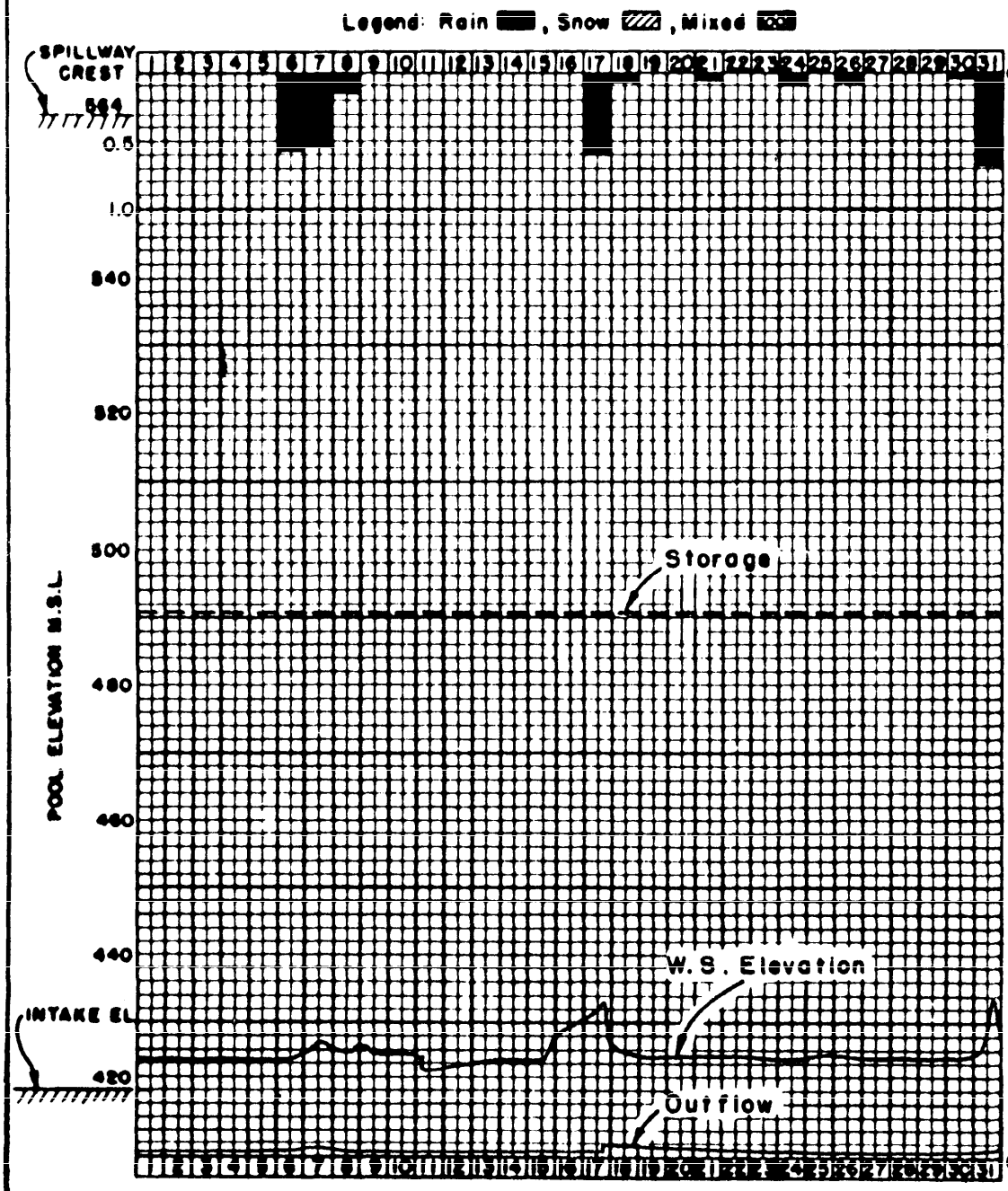
APRIL 1956

PLATE NO. 7

U.S. ARMY

CORPS OF ENGINEERS

Control Approval Symbol ENGNV-1



OCT. 1955

	ELEVATION	GROSS STORAGE Ac. Ft.
Conservation Pool	N/A	
Full Pool	564'	38,000

Outlet Capacity at Full Pool 7800 c.f.s.

Invert Elevation at Intake 420 ft. m.s.l.

MONTHLY RESERVOIR OPERATION

UNION VILLAGE RESERVOIR

CONNECTICUT RIVER BASIN

D.A. 124 SQ. MILES

NEW ENGLAND DIVISION

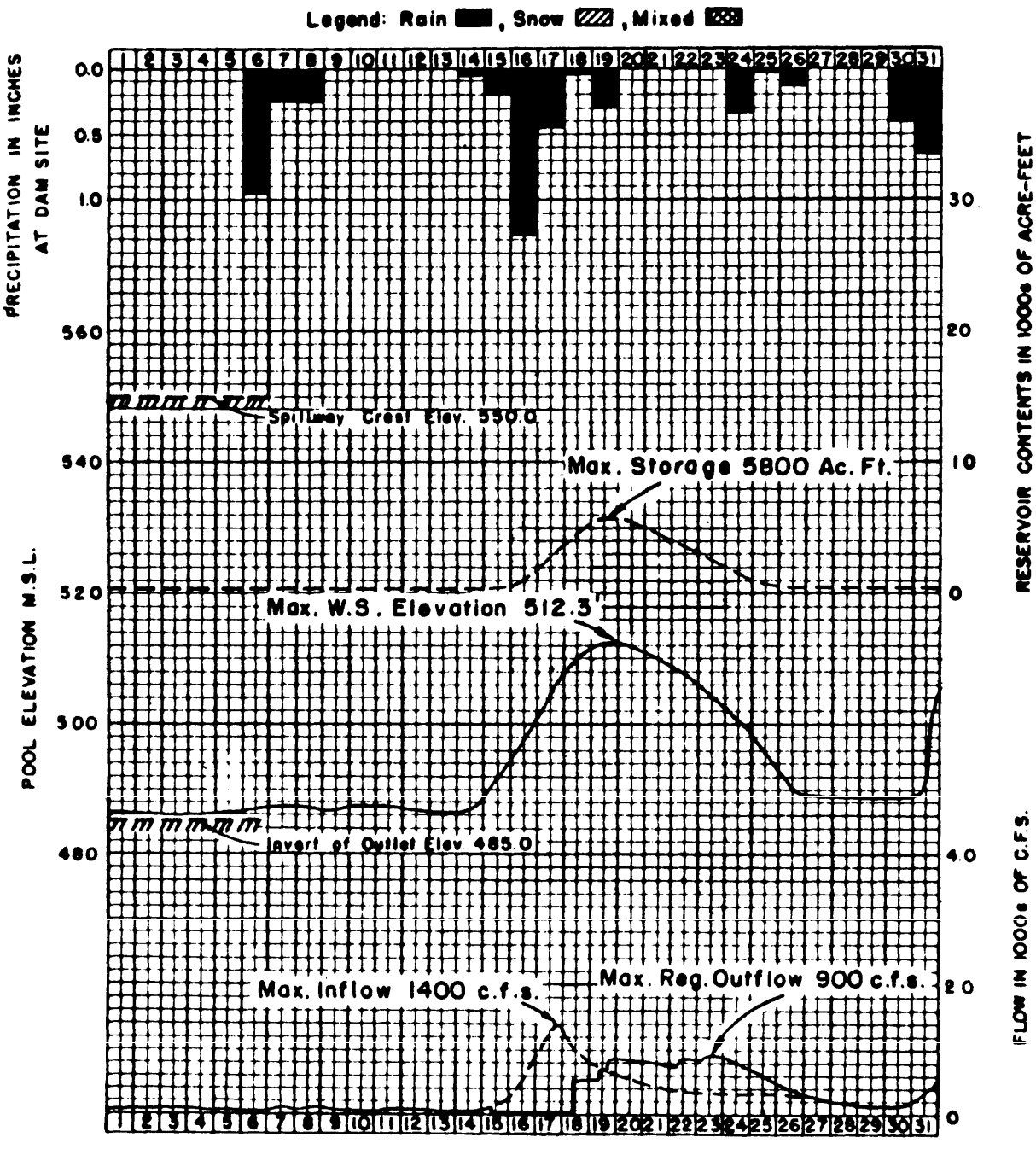
BOSTON, MASS.

PLATE NO. 8

U.S. ARMY

CORPS OF ENGINEERS

Control Approval Symbol ENGNV-1



MONTH OF OCT. 1955

	ELEVATION	GROSS STORAGE Ac. Ft.
Conservation Pool	NONE	
Full Pool	550.0	32500

Outlet Capacity at Full Pool 3660 c.f.s.

Invert Elevation at Intake 485 ft m s l

MONTHLY RESERVOIR OPERATION

SURRY MT. RESERVOIR

ASHUELOT RIVER BASIN

D.A. 100 SQ. MILES

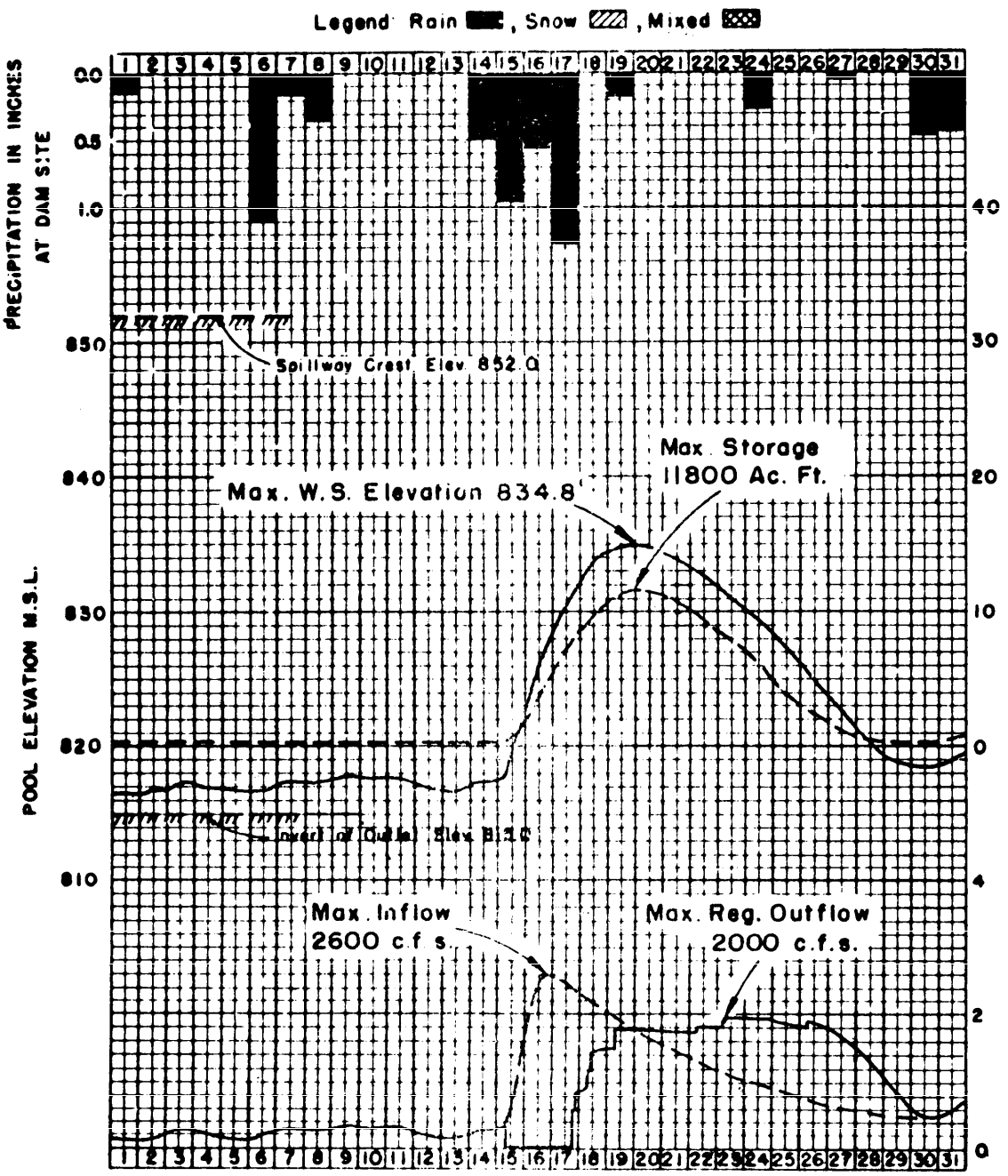
NEW ENGLAND DIVISION

BOSTON, MASS

PLATE NO. 9

U.S. ARMY

CORPS OF ENGINEERS
Control Approval Symbol ENGNV-1



MONTH OF OCT. 1955

MONTHLY RESERVOIR OPERATION

BIRCH HILL RESERVOIR
MILLERS RIVER BASIN
D.A. 175 SQ. MILES

	ELEVATION	GROSS STORAGE Ac. Ft.
Conservation Pool	NONE	
Full Pool	852	49,900

Outlet Capacity at Full Pool 10,500 c.f.s.

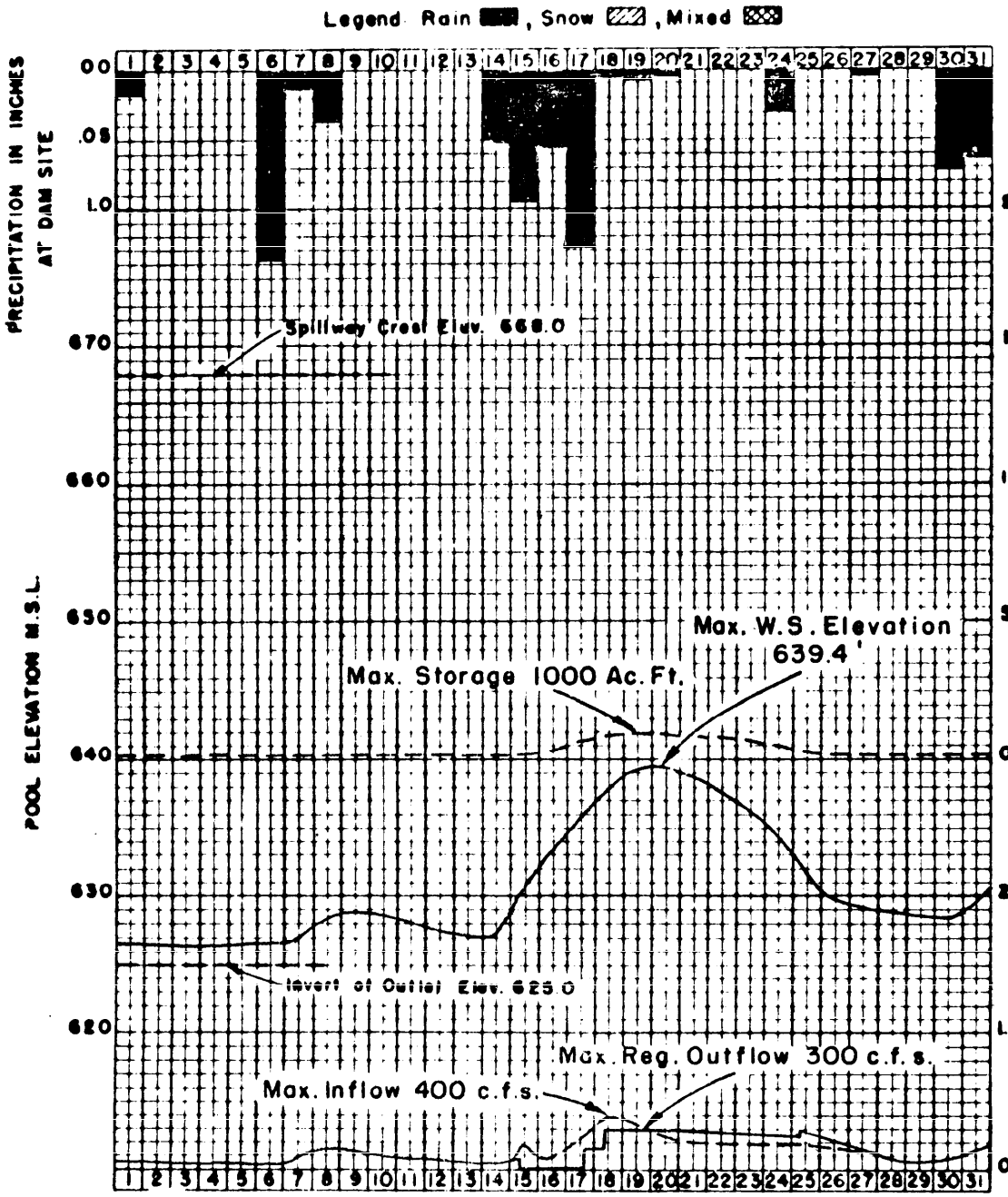
Invert Elevation at Intake 815 ft. m.s.l.

NEW ENGLAND DIVISION
BOSTON, MASS.

PLATE NO. 10

U.S. ARMY

CORPS OF ENGINEERS
Control Approval Symbol ENGNV-1



MONTH OF OCT. 1955

	ELEVATION	GROSS STORAGE Ac. Ft.
Conservation Pool	None	
Full Pool	668.0	22,000

Outlet Capacity at Full Pool 1,030 c.f.s.

Invert Elevation at Intake 625.0 ft. m.s.l.

MONTHLY RESERVOIR OPERATION

TULLY RESERVOIR

TULLY RIVER BASIN

D.A. 50 SQ. MILES

NEW ENGLAND DIVISION
BOSTON, MASS.

PLATE NO. 11

OCTOBER 1955

14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

RAINFALL IN INCHES

1

2

20

16

12

8

4

0

FLOW IN 1000 C.F.S.

600

580

560

540

520

500

480

4

2

0

ELEVATION IN FEET ABOVE M.S.L.

.60"

MAXIMUM ELEVATION 607.8'
96 % OF TOTAL RESERVOIR STORAGE

SPILLWAY CREST EL. 610.0

TOTAL RAINFALL
10.11 "AT DAM

POOL ELEVATION

20,000 C.F.S.

COMPUTED RESERVOIR INFLOW

REGULATED OUTFLOW

REGULATED OUTFLOW

OUTLET INVERT

CONNECTICUT RIVER FLOOD CONTROL

REGULATION AT
KNIGHTVILLE RESERVOIR
WESTFIELD RIVER MASS.
FLOOD OF OCTOBER, 1955

NEW ENGLAND DIVISION - BOSTON, MASS.

OCTOBER 1955

PLATE NO. 12

OCTOBER 1955

14 15 16 17 18 19 20

RAINFALL IN INCHES

1 2 3 4

TOTAL RAINFALL
5.70" AT DAM

SPILLWAY CREST

257

245

MAXIMUM ELEVATION 232.3'
34% OF TOTAL RESERVOIR STORAGE

POOL ELEVATION

ELEVATION IN FEET ABOVE M.S.L.

235 225 215 205 195

THAMES RIVER FLOOD CONTROL
REGULATION AT
MANSFIELD HOLLOW RESERVOIR
NATCHAUG RIVER CONNECTICUT
FLOOD OF OCTOBER 1955
NEW ENGLAND DIVISION — BOSTON, MASS.

6,600 C.F.S.

COMPUTED RESERVOIR INFLOW

OUTLET INVERT

REGULATED OUTFLOW

REGULATED OUTFLOW

FLOW IN 1000 C.F.S.

1 2 3 4 5 6

FLOW IN 1000 C.F.S.

1 2 3

14 15 16 17 18 19 20

OCTOBER 1955

PLATE NO. 13